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Engineering Report
No. 101-27

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V-52 KLYSTRON OSCILLATOR
DEVELOPMENT PROGRAM

Progress Report for
February 1954

Prepared for: Bureau of Ships
Navy Department

On: BuShips Contract No. NObsr-52503
Index No. NE-110420

By: Peter H. Kafitz

Approved:

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Vice-President for Engineering

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PURPOSE

The original purpose of the program covered by BuShips Contract No. NObsr-52503 was to develop a rugged local oscillator to comply with the Bureau of Ships Contract Specification SHIPS-O-419, dated 15 March 1951, which was subsequently modified at a conference held at the Bureau of Ordnance, Washington, D.C. on 20-21 May 1952 and later at a conference held at Varian Associates on 29-30 September 1952. The tube was to be a reflex klystron operating in the frequency range from approximately 8.5 to 9.6 kmc, and its performance was to be similar to the 2K25 except for severe restrictions on frequency drift with temperature, frequency change due to shock, and FM noise due to vibration.

An amendment to Contract No. NObsr-52503 executed on 10 July 1953 changed the scope of this contract to incorporate additional development work, as follows:

- I. Additional design work in connection with the prototype tube meeting the "1000-Tube Production Refinement Order Specification."
- II. Long-range extended development including:
 - A. Broadband matching to load: Elimination of the matching screw in the output iris to simplify the use of the tube.
 - B. Conduct an investigation to improve repeller or modulation sensitivity and reduce sensitivity variations over the frequency range and from tube to tube.
 - C. Elimination of undesirable modes.
 - D. Increase mechanical tuning range from 8.8 - 9.6 kmc to 8.5 - 9.6 kmc.

The product of the extended development program will be designated the VA-158, to differentiate it from the V-52 developed on the original contract.

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PROGRESS

During the past month three more VA-158 tubes were completed. This brings to nine the number of tubes of the final type which have been tested. Of the nine tubes, five have been equipped with silastic leads, painted, and inspected for shipment as sample tubes. The remaining four were rejected for the following reasons:

1. Cathode temperature-limited after being potted. (one tube)
2. Operation erratic due to particles in the grids. (two tubes)
3. Excessive warm-up drift. (one tube)

Table I gives a summary of the performance of the five successful sample tubes. These data were taken with no adjustments other than those made to the tuning screw and reflector voltage. The mode suppression screws were set to eliminate the unwanted modes over the entire tuning range and then soldered in place. The adjustment for the broadband output coupling was set once for each tube and also soldered in place. The tubes were tested over the full range of 3.5 to 9.6 kmc.

TABLE I
SUMMARY OF PERFORMANCE DATA OF VA-158 SAMPLE TUBES

| Tube No. | Beam Voltage (v) | Power Output | | Bandwidth | | Mod. Sens. | | 10-min Warm-up Drift | |
|----------|---------------------|--------------|-----|-------------|-----|---------------|-----|----------------------|------|
| | | Max (mw) | Min | Max (mw) | Min | Max (mc/v) | Min | Max (mc) | Min |
| 16 | 300 | 71 | 39 | 58 | 45 | 3.0 | 1.6 | | |
| | 350 | 160 | 96 | 60 | 46 | 1.8 | 1.0 | -2.5 | +2.7 |
| 18 | 300 | 64 | 44 | 52 | 42 | 2.7 | 1.7 | | |
| | 350 | 144 | 105 | 42 | 41 | 1.9 | 1.2 | -1.9 | 0.0 |
| 21 | 300 | 57 | 27 | 59 | 42 | 3.1 | 1.9 | | |
| | 350 | 129 | 68 | 58 | 44 | 1.7 | 1.2 | -6.6 | -3.5 |
| 20 | 300 | 56 | 40 | 51 | 44 | 2.4 | 1.4 | | |
| | 350 | 132 | 102 | 52 | 44 | 1.5 | 1.1 | -5.0 | -3.6 |
| 22 | 300 | 71 | 37 | 45 | 39 | 2.6 | 1.6 | | |
| | 350 | 157 | 89 | 44 | 39 | 1.6 | 1.0 | -1.0* | |

* data at mid-point of range only

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It should be emphasized that these are experimental tubes which were built to study only the r-f characteristics of the design. No particular effort was made to minimize the thermal drift.

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PROGRAM FOR NEXT INTERVAL

No further work is planned on this project at this time. A proposal is now being prepared for additional work to be performed in the near future.

Estimated expenditures during February 1954: \$8,340.00

Estimated man-hours during February 1954: 781

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